

**A NEW SPECIES OF *PHACELOCOCCUS* MILLER  
(HEMIPTERA: COCCOIDEA: ERIOCOCCIDAE)  
ON *BURSARIA* (PITTOSPORACEAE)**

NATE B. HARDY and PENNY J. GULLAN

*Department of Entomology, University of California, One Shields Avenue, Davis, California  
95616, USA. (E-mail: nbhardy@ucdavis.edu; pjgullan@ucdavis.edu)*

**Abstract**

The adult female of a new species of felt scale, *Phacelococcus bursaria* sp. n., is described from *Bursaria spinosa* (Pittosporaceae) in southeastern Australia. This is the first record of the genus *Phacelococcus* Miller from a host plant other than *Eucalyptus* (Myrtaceae). An updated key to the five species of *Phacelococcus* is provided. Additional records of *P. frenchi* Gullan & Strong and *P. subcorticalis* Gullan & Strong are reported, including the first collection of *P. frenchi* from Tasmania.

**Introduction**

The Eriococcidae is the fourth largest family of scale insects (*ca* 550 described spp.) and is most diverse in the southern hemisphere, especially Australia (*ca* 150 described spp.) (Miller and Gimpel 2000, 2006). Most of the Australian eriococcid diversity (*ca* 120 described spp.) occurs on hosts in the family Myrtaceae, although some species feed on more than one family. Other than Myrtaceae, the only plant families in Australia that are fed upon by more than one described eriococcid species are Casuarinaceae (15 spp.), Pittosporaceae (4 spp.), Fabaceae (3 spp.), Araucariaceae (2 spp.), Asteraceae (2 spp.), Proteaceae (2 spp.) and Cupressaceae (2 spp.).

The genus *Phacelococcus* was erected by Miller (1970) for a single species (*P. brookesae* Miller) found under the bark of *Eucalyptus globulus* (Myrtaceae) in Tasmania. Gullan and Strong (1997) described three additional species occurring in or under the bark of *Eucalyptus* species in the southeastern region of the Australian mainland. Adult females of all species of *Phacelococcus* are small and cryptic in habit, but at least two species, *P. frenchi* Gullan & Strong and *P. subcorticalis* Gullan & Strong, can be so locally abundant as to be a food source for Australian marsupial possums and gliders (Gullan and Strong 1997). Adult females of *Phacelococcus* can be distinguished from those of other Australian eriococcids by their (i) globular or ovoid body, (ii) small legs relative to body size, (iii) reduced and membranous anal lobes, and (iv) ventral clusters of quinquelocular pores. A new species of *Phacelococcus* is recorded here from bark on *Bursaria spinosa* (Pittosporaceae), which is the first non-eucalypt host for *Phacelococcus*. This species conforms to the generic concept of Gullan and Strong (1997) with the following exceptions: (i) enlarged dorsal setae are present, and (ii) ventral clusters of quinquelocular pores are absent from around the spiracles.

Plants in the genus *Bursaria* are spinose shrubs common in the understory of eucalypt woodlands in all but the most arid or alpine regions of Australia

(Cayzer *et al.* 1999). Seven species are recognized, of which only *B. spinosa* is widespread. Cayzer *et al.* (1999) recognized two subspecies of *B. spinosa*, with *B. spinosa* ssp. *spinosa* being the widespread, typical form which, based on the collection locality, is almost certainly the host of the eriococcid described in this paper. The other six *Bursaria* species have more restricted distributions, some of which are very restricted, such as on serpentine outcroppings in Queensland (*B. reevesii*) or on south-facing sandstone cliffs in the Blue Mountains of New South Wales (*B. longisepala*).

Eight species of scale insect are known to feed on *Bursaria* (Ben-Dov *et al.* 2006). Three of these are polyphagous species with worldwide distributions: the soft scales *Ceroplastes destructor* Newstead and *C. sinensis* Del Guercio (Coccidae), and the cottony-cushion scale *Icerya purchasi* Maskell (Monophlebidae). *Eriococcus bursariae* Froggatt and *E. villosus* Froggatt (Eriococcidae) are known only from *B. spinosa* in New South Wales. *Eriococcus eucalypti* Maskell, *E. tepperi* Maskell and *Cerococcus paradoxus* (Maskell) (Cerococcidae) have been recorded on *Bursaria* as well as other host plants, although the record of *E. tepperi* on *Bursaria* may be erroneous (P.J. Gullan, unpublished data).

In this paper, we describe and illustrate the adult female of the new species of *Phacelococcus* from *B. spinosa*. A revised key to *Phacelococcus* species and additional records of *P. frenchi* and *P. subcorticalis* are provided.

### Materials and methods

This work is based largely on the collection of the late Dr J.W. Beardsley, which is housed in the BPBM (see below). The BPBM has allowed the holotype of any new Australian species from Dr Beardsley's collection to be deposited in the ANIC (in correspondence of P.J. Gullan, 1996). Slide-mounts prepared by J.W. Beardsley usually have more than one insect per slide. Freshly collected specimens were mounted one adult female per microscope slide, using the slide-mounting method of Gullan (1984). Measurements were made using an ocular micrometer in the eyepiece of a compound microscope. All specimens listed were measured and descriptions are based on all available material. The morphological terms for Eriococcidae follow those of Hoy (1962), Miller and McKenzie (1967) and Williams (1985). An illustration of the adult female was prepared with a drawing tube and the Adobe programs Photoshop CS and Illustrator CS. Following the convention for scale insects, the taxonomic drawing displays the dorsal body surface on the left side of the page, and the ventral body surface on the right. In all but the smallest adult female of this new *Phacelococcus* species, the ventral body surface is larger than the dorsal body surface, which is demarcated by the presence of enlarged setae. Therefore, the most lateral part of the venter is visible from the dorsal aspect and is shown on the left side of the main figure. Enlargements of diagnostic features are located around the margin of the main figure; their sizes are provided in the text.

Specimen depositories: ANIC – Australian National Insect Collection, CSIRO Entomology, Canberra, A.C.T., Australia; BMNH – The Natural History Museum, London, U.K.; BPBM – Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.; NMV – Museum Victoria, Melbourne, Victoria, Australia; TASAG – Tasmanian Department of Primary Industries & Water, New Town, Tasmania, Australia.

### Key to adult females of *Phacelococcus* species

(Modified from Gullan and Strong 1997)

- 1 Macrotubular ducts absent from dorsum ..... 2
- Macrotubular ducts present on dorsum ..... 3
- 2 Macrotubular ducts present on ventral surface of abdomen; anal ring dorsal, with 6 setae; quinquelocular pores clustered near margin on each side of each body segment; microtubular ducts present on ventral surface of head, between antennae ..... *P. bursaria* sp. n.
- Macrotubular ducts absent from ventral surface of abdomen; anal ring ventral, with 8 setae; quinquelocular pores clustered on medial areas of posterior abdominal segments; microtubular ducts absent from ventral surface of head ..... *P. subcorticalis* Gullan & Strong
- 3 Bilocular pores absent; cuticular evagination (cauda) anterior to anal ring absent ..... *P. frenchi* Gullan & Strong
- Bilocular pores present on dorsum; cuticular evagination anterior to anal ring present ..... 4
- 4 Quinquelocular pores in numerous clusters throughout most of venter, with most clusters with 3–35 pores on head and thorax; body 2.9–3.9 mm long and 2.5–3.2 mm wide ..... *P. brookesae* Miller
- Quinquelocular pores in clusters scattered on most of venter, with pores on head and thorax rarely in groups of more than 2–4; body 1.2–2.0 mm long and 1.0–1.7 mm wide ..... *P. cookae* Gullan & Strong

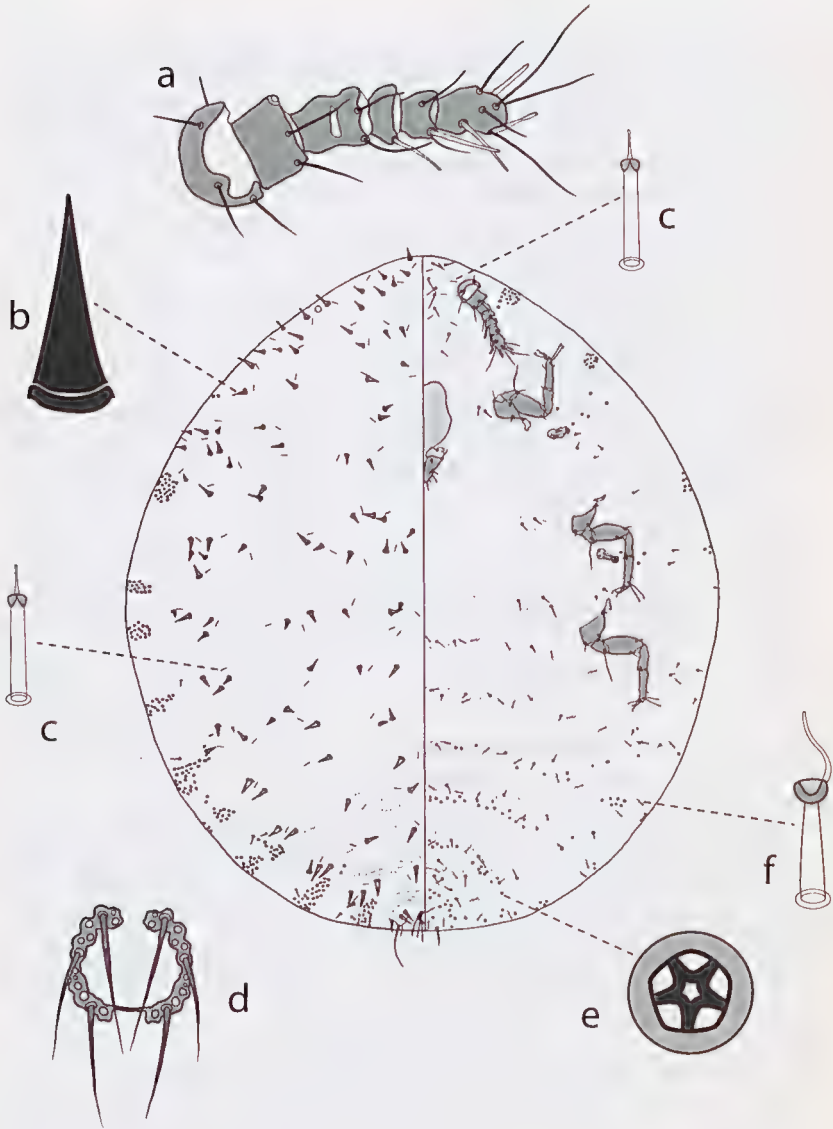
### *Phacelococcus* Miller

Type species. *Phacelococcus brookesae* Miller, 1970, by original designation.

### *Phacelococcus bursaria* sp. n.

(Fig. 1)

*Types.* Holotype adult ♀, on slide with 2 paratype adult ♀♀ (holotype farthest from data label), AUSTRALIA: Victoria, Lower Plenty, on bark of *Bursaria spinosa*, J.W. Beardsley, V-152, 24.x.1971 (ANIC). *Paratypes:* 15 adult ♀♀, same data as holotype (2 slides in ANIC, 3 slides in BPBM); 14 adult ♀♀, same data as holotype except: in bark crevices of *B. spinosa*, V-41, 11.ix.1971 (4 slides in BPBM); 4 adult ♀♀, Tasmania, Hobart, ex *B. spinosa*, N.M. Hudson, W.30, C.I.E. 6899, 10.viii.1962 (BMNH).



**Fig. 1.** Adult female of *Phacelococcus bursaria*. Enlargements show: (a) antenna; (b) dorsal seta; (c) microtubular duct; (d) anal ring; (e) quinquelocular pore; (f) macrotubular duct. On the mature adult female illustrated here, the ventral body surface is larger than dorsal body surface (latter demarcated by the enlarged setae) and thus the ventrolateral margin is visible from the dorsal aspect and figured on the left side of the main figure.



*Diagnosis.* The adult female of *P. bursaria* can be distinguished from the adult females of other *Phacelococcus* species by its (i) enlarged subconical setae on dorsum (short, robust and flagellate in other species), (ii) clusters of quinquelocular pores restricted to margin of each body segment (present on at least most of venter in other species), (iii) microtubular ducts on ventral surface of head (absent on venter of head in other species), (iv) macrotubular ducts only on ventral surface of abdominal segments, (v) single pair of setae on basal segment of labium (2 pairs in other species), and (vi) feeding on *Bursaria* (all other known species in or under eucalypt bark).

*Description of adult female.* Body outline oval; length 0.84-1.30 mm (1.20 for holotype), greatest width 0.54-1.11 mm (1.04 for holotype). Eyes 13-18  $\mu\text{m}$  wide, on margin. Antennae (Fig. 1a) 6- to 7-segmented (segments III+IV often fused), length 110-145  $\mu\text{m}$ ; with 4 hair-like setae on segment I, 2 hair-like setae on segment II, 0 setae on segment III, 2 hair-like setae on segment IV, 1 fleshy seta on segment V, 2 hair-like setae and 1 fleshy seta on segment VI, and *ca* 6 hair-like setae and 3 fleshy setae on segment VII. Tentorial box 107-138  $\mu\text{m}$  long, 80-113  $\mu\text{m}$  wide. Labium 63-75  $\mu\text{m}$  long, 50-75  $\mu\text{m}$  wide, 3-segmented; with 1 pair of setae on membranous basal segment, 1 pair of setae on medial segment, and 6 pairs of setae on apical segment (3 pairs of hair-like setae and 1 sub-apical pair of fleshy setae on ventral surface, 1 pair of apical minute setae, and 1 pair of hair-like setae on dorsal surface). Spiracular peritremes 28-40  $\mu\text{m}$  long, 12-15  $\mu\text{m}$  wide across atrium. Legs: trochanter + femur 67-95  $\mu\text{m}$  long, tibia + tarsus 75-110  $\mu\text{m}$  long, claw 16-23  $\mu\text{m}$  long, tarsal digitules 25-35  $\mu\text{m}$  long, claw digitules 15-25  $\mu\text{m}$  long; fore coxa with 6 setae, mid and hind coxa with 5 setae, trochanter with 4 setae, femur with 3 setae, tibia with 3 setae, tarsus with 4 setae; translucent pores 1-2  $\mu\text{m}$  in diameter, 20-30 pores on dorsal surface of each hind coxa. Anal ring (Fig. 1d) 30-35  $\mu\text{m}$  wide, with 6 setae, 26-45  $\mu\text{m}$  long; anal ring pores 1-3  $\mu\text{m}$  in diameter. Suranal setae *ca* 25  $\mu\text{m}$  long, with acute apices. Anal lobes weakly developed, membranous; 2 medial lobe setae each 15-38  $\mu\text{m}$  long, lateral lobe seta 8-33  $\mu\text{m}$  long or absent, ventral lobe seta 15-33  $\mu\text{m}$  long; caudal seta 70-90  $\mu\text{m}$  long. Evagination (cauda) anterior to anal ring absent.

*Dorsum.* Smaller than venter, delineated by enlarged setae. Derm membranous. Dorsal setae (Fig. 1b) 10-33  $\mu\text{m}$  long, subconical; cluster of 1-3 setae dorsad of pore clusters on each side of each abdominal segment, 1 medial seta and 1 submedial seta on each side of each abdominal segment, anterior abdominal segments with additional setae, head and thorax with scattered setae. Macrotubular ducts absent. Microtubular ducts (Fig. 1c) *ca* 9  $\mu\text{m}$  long, each with weak rim around dermal orifice, *ca* 2  $\mu\text{m}$  in diameter; 1 or more ducts near each seta or group of setae. Bilocular pores absent.

*Venter.* Ventral setae 8-20  $\mu\text{m}$  long, in a transverse row across each abdominal segment and scattered around margin; setae medial of each coxa

9-25  $\mu\text{m}$  long; elongate setae (8-40  $\mu\text{m}$  long) in paired, longitudinal series on head, extending from level of scape towards mouthparts. Macrotubular ducts (Fig. 1f) *ca* 10  $\mu\text{m}$  long, duct shaft tapering slightly to inner end, each duct with weak rim around dermal orifice, *ca* 3  $\mu\text{m}$  in diameter; arranged in transverse row across each abdominal segment. Microtubular ducts same as those on dorsum, on mesal portion of head, amongst elongate setae. Quinquelocular pores (Fig. 1e) *ca* 4  $\mu\text{m}$  in diameter, 10-15 pores on each side of abdominal segment VIII, in clusters of 5-40 pores on margin on each side of each body segment anterior to abdominal segment VIII [many of these appear on the left side of the main figure because the venter is larger than the dorsum in mature adult females], pores in transverse rows across each of abdominal segments IV-VI (no pores on ventromedial portion of abdominal segment VII), and a small cluster near each spiracle.

*Etymology.* The species' name is taken from that of its host. It is a noun in apposition.

*Comment.* In his field notebook, Beardsley recorded that on 11 September 1971, adult females were forming ovisacs and ovipositing.

#### **Additional records of *Phacelococcus***

*Phacelococcus frenchi* Gullan & Strong, 1997: 235.

*Material examined.* Victoria: 6 adult ♀♀ (including DNA voucher NH127), Tyabb, near Yaringa Boat Harbour, corner of Katandra Road and Lumeah Road, 38°14'54"S, 145°14'26"E, in furrow of fibrous bark where branch joined trunk on *Eucalyptus radiata*, N.B. Hardy and P.J. Gullan, 15.ii.2005 (4 slides in ANIC, 2 slides in NMV). Tasmania: 11 adult ♀♀ (including DNA voucher NH96), 3 slides of embryos, *ca* 6 km NW of Bicheno, *ca* 3 km W of Tasman Highway on road to Douglas-Apsley National Park, near creek, 41°51'38"S, 148°14'21"E, under bark of narrow-leaved eucalypt, P.J. Gullan, 27.i.2006 (12 slides in ANIC, 2 slides in TASAG).

*Comment.* This is the first collection of *P. frenchi* from Tasmania (previous records were limited to ACT and Victoria).

*Phacelococcus subcorticalis* Gullan & Strong, 1997: 236.

*Material examined.* Victoria: 11 adult ♀♀ (including DNA voucher NH131), Toolangi State Forest, Sylvia Creek Road near Wirrawilla Rainforest Walk, 37°31'46"S, 145°31'18"E, ex fibrous bark of *Eucalyptus ?regnans*, N.B. Hardy and P.J. Gullan, 16.ii.2005 (9 slides in ANIC, 2 slides in NMV).

*Comments.* The type locality in the Brindabella Range, Australian Capital Territory, was devastated by the January 2003 bushfires that burned in many parts of southeastern Australia, following a drought that ranked as one of the worst in over a hundred years of official Australian weather records (Worboys 2003). The mature host trees of *E. fastigata* at the type locality were severely burnt (P.J. Gullan personal observation, Feb. 2004) and it is not known whether any populations of *P. subcorticalis* survived in the area.

## Acknowledgements

The B.P. Bishop Museum, Hawaii, loaned the late Dr Beardsley's collection of Australian eriococcids to Penny Gullan. Dr Ferenc Kozár kindly sent us specimens to examine from his BMNH loan, with permission of Dr Jon Martin. Dr Chris Hodgson provided helpful comments on a draft of the manuscript. This research was supported by a National Science Foundation PEET grant DEB-0118718 to Penny Gullan, and an Australian Biological Resources Study Participatory Program research grant to Lyn Cook and Penny Gullan. Jim Parsons assisted with fieldwork during collections made in February 2005. The Department of Sustainability and Environment, Victoria, provided a permit (# 10002997 to Penny Gullan) to collect scale insects in Victorian Parks, and Dr Ken Walker, Museum Victoria, assisted with paperwork to allow export of the material for study. The Department of Primary Industries and Water, Tasmania, provided a permit (# FA 05128 to Penny Gullan) to collect scale insects in Tasmania in 2006.

## References

- BEN-DOV, Y., MILLER, D.R. and GIBSON, G.A.P. 2006. *ScaleNet: a database of the scale insects of the World*. Scales in a Region Query Results, and Scales on a Host Query Results. <http://www.sel.barc.usda.gov/SCALETNET/SCALETNET.HTM> (accessed 9 September 2006).
- CAYZER, L.W., CRISP, M.D. and TELFORD, I.R.H. 1999. *Bursaria* (Pittosporaceae): a morphometric analysis and revision. *Australian Journal of Systematic Botany* **12**: 117-143.
- GULLAN, P.J. 1984. A revision of the gall-forming coccoid genus *Apiomorpha* Rübsaaman (Homoptera: Eriococcidae: Apiomorphinae). *Australian Journal of Zoology, Supplementary Series* No. **97**: 1-203.
- GULLAN, P.J. and STRONG, K.L. 1997. Scale insects under eucalypt bark: a revision of the Australian genus *Phacelococcus* Miller (Hemiptera: Coccoidea: Eriococcidae). *Australian Journal of Entomology* **36**: 229-240.
- HOY, J.M. 1962. Eriococcidae (Homoptera: Coccoidea) of New Zealand. *New Zealand Department of Scientific and Industrial Research Bulletin* **146**: 1-219.
- MILLER, D.R. 1970. A new genus and species of scale insect from Tasmania (Homoptera: Coccoidea: Eriococcidae). *Journal of the Australian Entomological Society* **9**: 157-159.
- MILLER, D.R. and GIMPEL, M.E. 2000. *A systematic catalogue of the Eriococcidae (felt scales) (Hemiptera: Coccoidea) of the World*. Intercept Limited, Andover, UK; 589 pp.
- MILLER, D.R. and GIMPEL, M.E. 2006. *ScaleNet*. Eriococcidae. <http://www.sel.barc.usda.gov/SCALETNET/SCALETNET.HTM> (accessed 9 September 2006).
- MILLER, D.R. and MCKENZIE, H.L. 1967. A systematic study of *Ovaticoccus* Kloet and its relatives, with a key to North American genera of Eriococcidae (Homoptera: Coccoidea: Eriococcidae). *Hilgardia* **38**: 471-539.
- WILLIAMS, D.J. 1985. The British and some other European Eriococcidae (Homoptera: Coccoidea). *Bulletin of the British Museum (Natural History), Entomology Series* **51**(4): 347-393.
- WORBOYS, G. 2003. A brief report on the 2003 Australian Alps bushfires. *Mountain Research and Development* **23**(3): 294-295. Available at <http://www.bioone.org/>